HEP Programs at ANL and the FY 2003 Budget

HEPAP
Fermilab

April 26, 2002

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Argonne National Laboratory

Scientific Research Areas

Accelerator Physics

- **Development and use of Argonne Wakefield Accelerator (AWA) testbed to demonstrate wakefield acceleration in dielectrics and plasmas**
  - *record-setting electron gun driving linac testbed to generate wakefields; goal of 100 MeV in 1 m demo*

Theoretical Physics

- **A balanced program of formal, phenomenological and computational physics**

Experimental Physics

- **Multi-year experiments and programs of systematic measurements using detector systems built in collaboration with university and laboratory groups in the US and abroad.**

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Argonne plays key roles in the US HEP program

Building detectors

Inventing and developing technology for HEP

Making detectors work for physics

Analysis and physics results (expt and theory)

Collaboration with universities

Leadership

> Most detector responsibilities are funded by a mix of base and project funds, as described in MOUs. Operational responsibilities are mostly supported from the base program
>
> Budget reductions have brought us to the point that we cannot fulfill all that we have agreed to
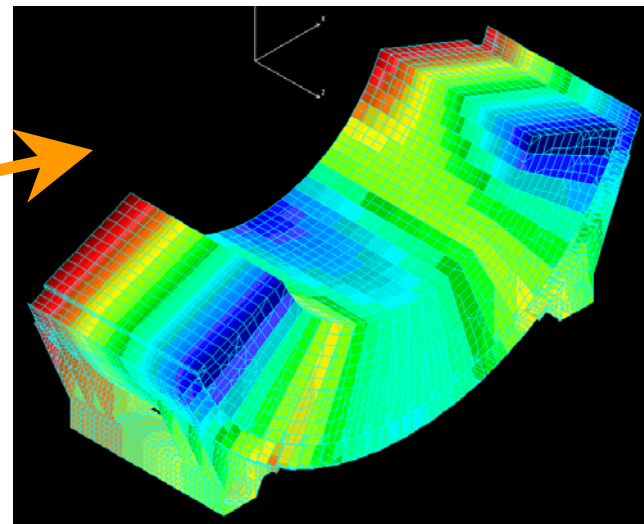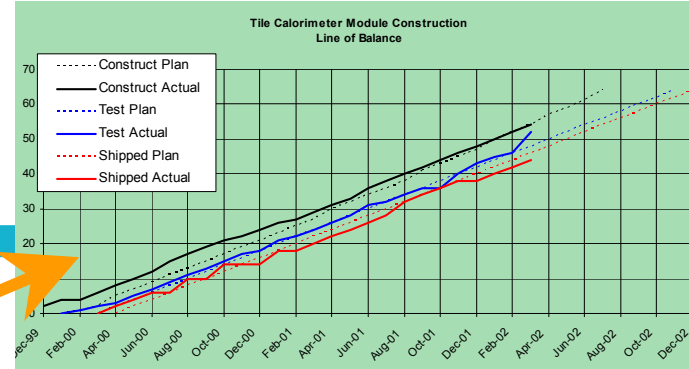
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Building detectors

ATLAS Tile Calorimeter is finishing fabrication on schedule and preparing for pre-operations and installation

MINOS scintillator module fabrication is over half completed at ANL, Caltech, and U. Minn. Final detector planes being assembled


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Building detectors

Gigabit Ethernet "Link Source Card" developed to permit additional use of commodity hardware with ROI Builder and the rest of the ATLAS HLT (LHCB also interested)

ANL design/prototyping of MINOS near-detector front-end electronics.

– **Final prototypes (before production) fully operational in Vertical Slice Test Stand at ANL in close collaboration with Fermilab, Rutherford, IIT, Oxford and UC London**


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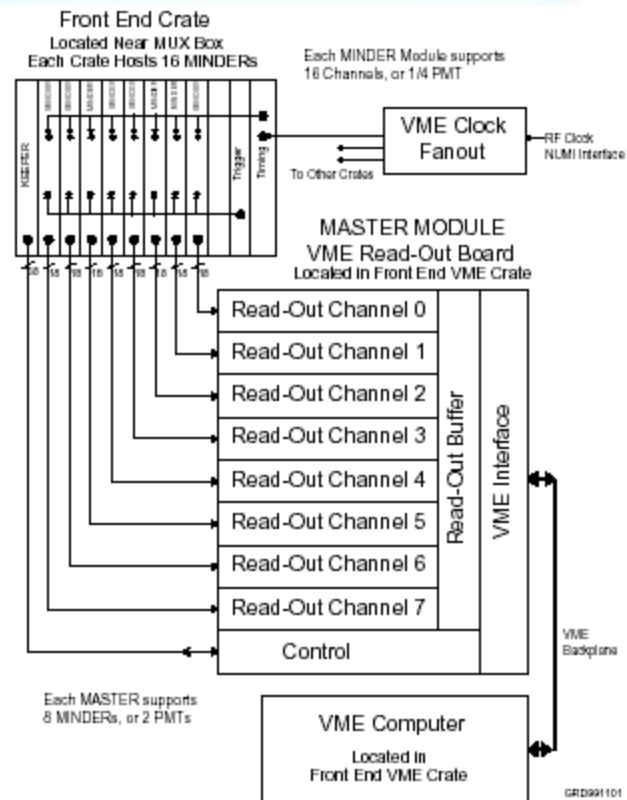
Building detectors

ATLAS Computing

- Provided persistence service for Pythia, Isajet, Herwig, ATLFast

- Provided event generation and fast simulation chain for Data Challenge 0

- Provided support for two other DC0 chains

- ATLAS data management architecture document presented to October collaboration meeting

- Provided grid data access from ATLAS Athena framework

- Provided virtual data machinery for DC1 Phase 1

- Led first LHC RTAG that defined a persistency common project

- Convened first workshop of core software and grid developers

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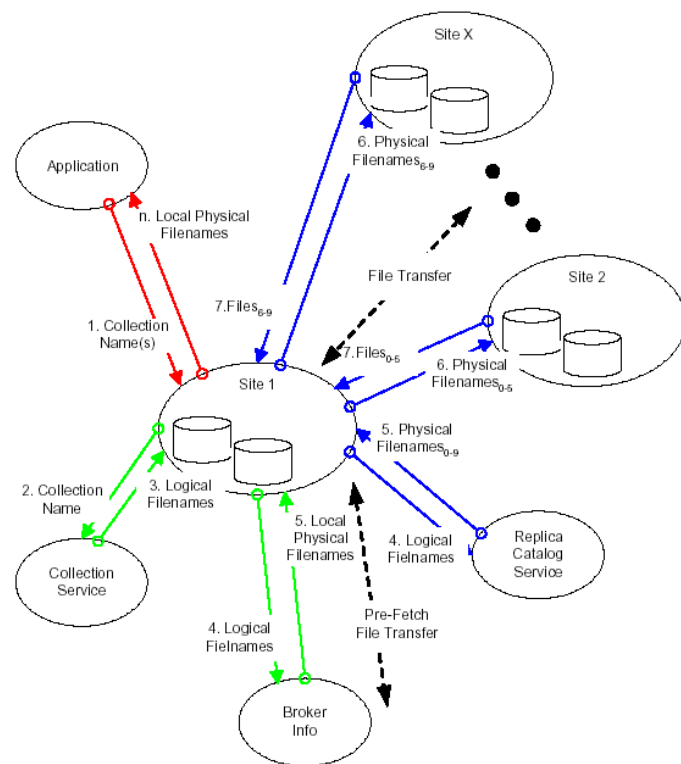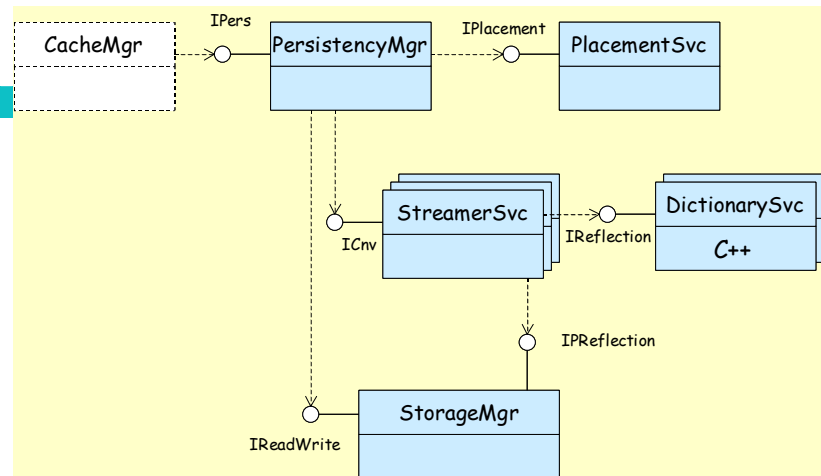
Inventing & developing technology

The new AWA gun is commissioned

– **high charge, high energy (> 8 MeV), high brightness (< 2 mm-mrad/nC) operation. Pulse train mode with > 40 nC/pulse, > 60 pulses/sec**

– **Conditioned at full power > 80 MV/m on cathode.**

– **20 nC pulses with Cu cathode; expect >100 nC with Mg cathode**

– **Ultra stable, all solid state Ti:Sapphire laser being installed (> 2 mJ UV pp)**

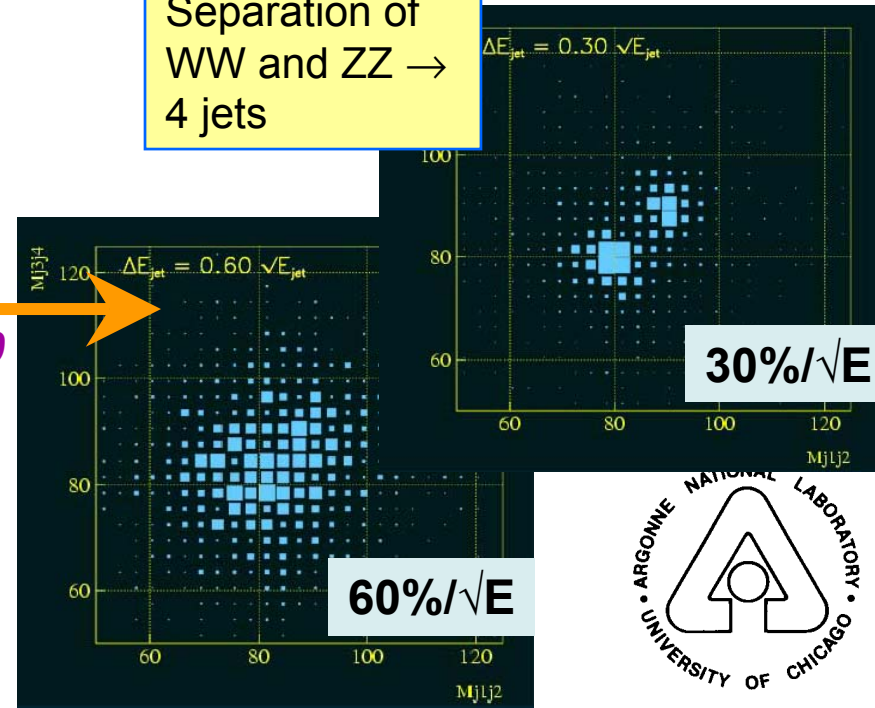## Calorimetry for the Linear Collider

– **Focus on jet resolution**

  ◆ *Many important final states have 2-10 jets*

  ◆ *Explore digital Hcal for use with energy flow algorithms*

Next generation neutrino detectors

– *E.g.,* NuMI off axis detector

Laser input mirror

Camera

Separation of WW and ZZ → 4 jets

$\Delta E_{jet} = 0.30 \sqrt{E_{jet}}$

$\Delta E_{jet} = 0.60 \sqrt{E_{jet}}$

30%/√E

60%/√E

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Making detectors work for physics

CDF

- Specific Run II responsibility for shower max and preshower detectors, including front-end electronics

- Continuing responsibility for central EM cal, including overall calibration procedures

- As a result, ANL has generally taken major responsibility for overall electron calibration and identification

  - *Crucial for high E_T e id for W, Z, top, and many b-physics signatures, including flavor-tagging*
  - *Lead role in L2 e and γ trigger implementation*

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UNIVERSITY OF CHICAGO
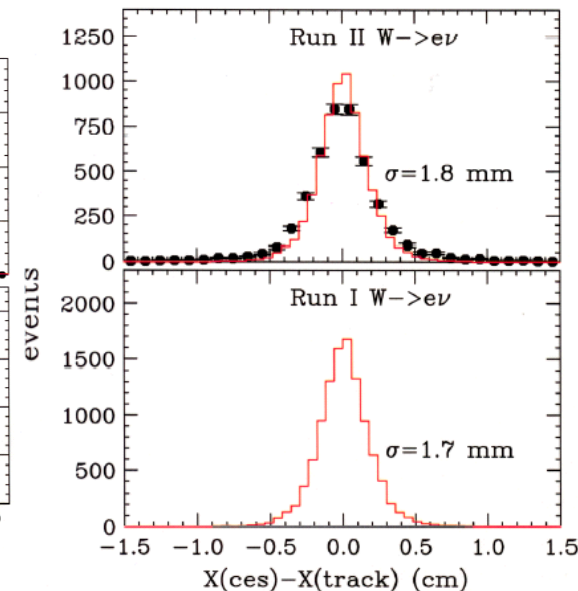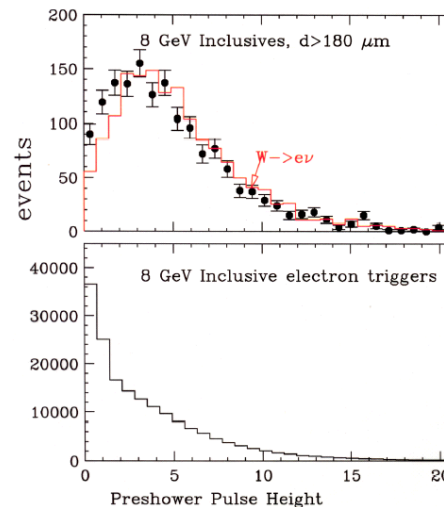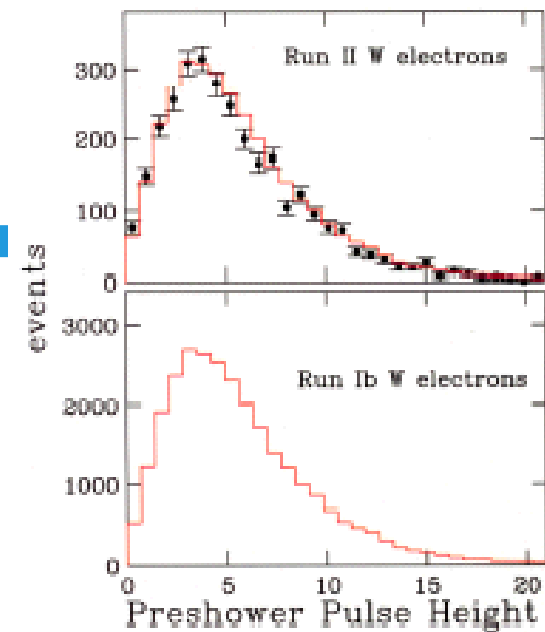
Making detectors work for physics

ZEUS Operating Responsibilities

- Calorimeter
- Calorimeter First Level Trigger Processor
- SRTD Trigger
- Presampler
- Straw Tube Tracker

ATLAS Preops (start now)

- Calorimeter preassembly
- Test beam module calibration

NuMI/MINOS Beam Line

- NuMI neutrino beam devices in critical areas of construction, integration, installation.
    - *Hot handling facility construction*
    - *horn alignment system,*
   - *neutrino beam diagnostic device implementation*

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Physics results

ZEUS continues to be very productive, with focus on structure functions, QCD, and diffraction

– *E.g.*, high precision jet studies with errors of only a few %

Wakefield accelerator rf structure and waveguide coupling studies

– *E.g.*, simulation of new design for X-band Dielectric Loaded Accelerator

ZEUS

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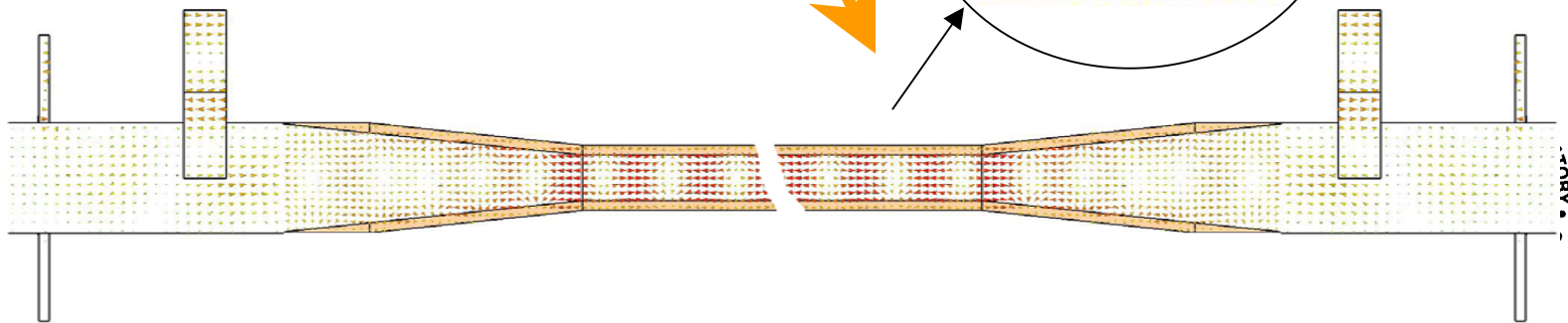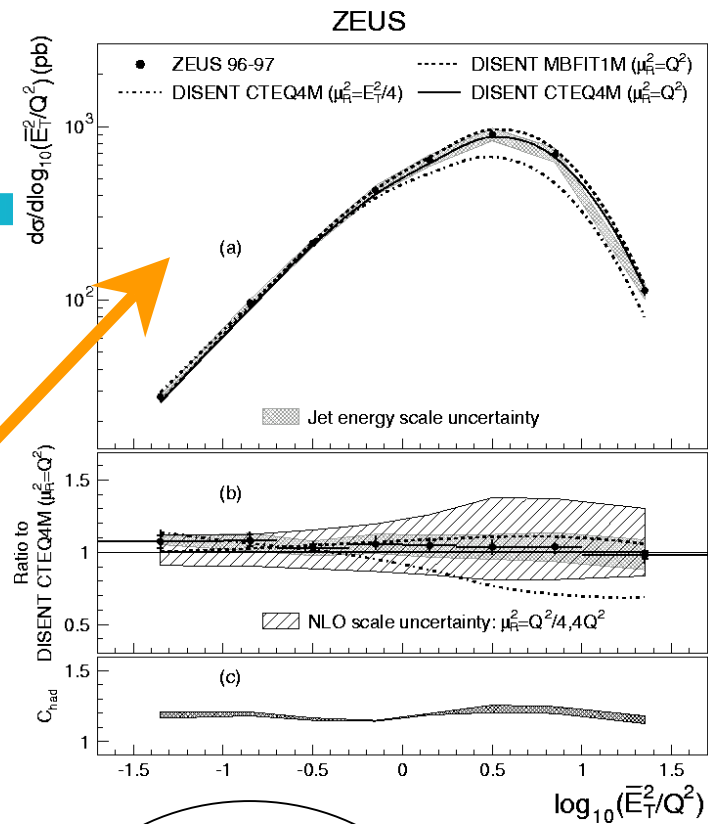
Physics results
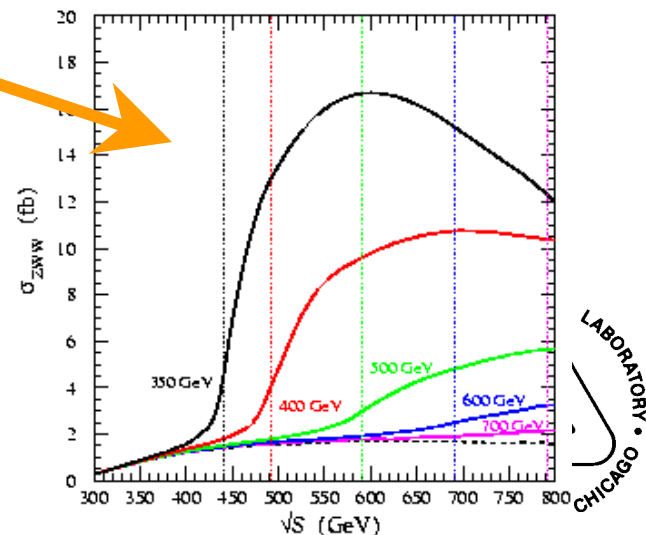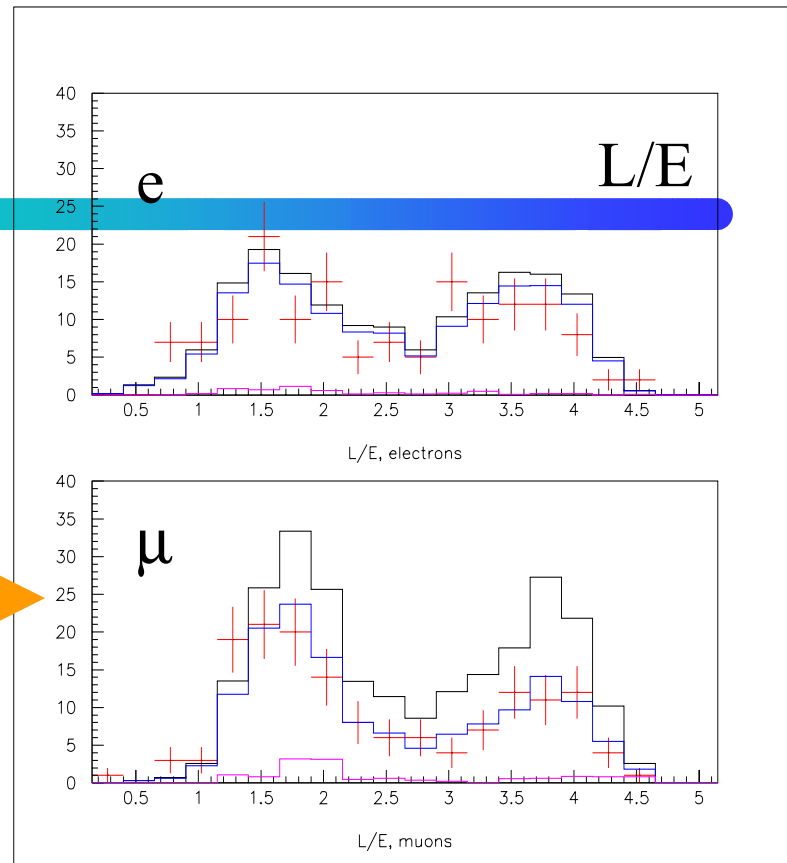
Soudan 2

- Confirmation and study of atmospheric neutrino deficit first seen in Super-K and previous water C detectors

Theory—many results

- *E.g.*, PROBING HEAVY HIGGS BOSON MODELS WITH A TEV LINEAR COLLIDER (Choudhury, Tait, Wagner)
  - ◆ *comprehensive study of heavy Higgs probes possible at TeV linear colliders*
  - ◆ *New signatures were identified in specific models,*

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Principal University Collaborators

Univ. Wisconsin

Penn State Univ.

Michigan State Univ.

Univ. Chicago

Univ. Illinois

Univ. Texas at Arlington

Indiana Univ.

Univ. Chicago

Illinois Institute of Technology

Columbia

Harvard

Western Washington

UCLA

Michigan

Yale

Berkeley

Rochester

Brandeis

Rockefeller

Texas Tech

Wisconsin

Tufts Univ.

Univ. Minnesota

Caltech

Univ. of Texas at Austin

Project Leadership

Rik Yoshida is the chairman of the US ZEUS collaboration

- Just finished term as ZEUS Deputy Spokesman

Dave Ayres is Deputy Spokesman of MINOS

Dave Ayres is Deputy MINOS Manager

Malcolm Derrick (ret) is ZEUS Physics Chairman

Jim Proudfoot is Associate Head of CDF Operations

Physics Analysis Coordinators

- ZEUS QCD (Sergei Chekanov)
- ZEUS Structure Functions (Rik Yoshida)
- CDF QCD (Bob Blair, just completed term)

Shift Leaders: Zeus, CDF, MINOS

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Project Leadership

Detector system Coordinators

- ZEUS Presampler (Steve Magill)
- US ATLAS Tile Calorimeter (Larry Price)
  - *Mechanical components (Jim Proudfoot)*
- US ATLAS Trigger/DAQ (Bob Blair)
- ATLAS Tile Test Beam Coordinator (Bob Stanek)
- ATLAS Database Coordinator (David Malon)
- CDF Calorimeter Coordinator (Karen Byrum)
- CDF Run IIb Presampler (Steve Kuhlmann)
- MINOS Electronics (Jonathan Thron)
  - *Near Detector front ends (Gary Drake)*
- MINOS Installation at Soudan (Dave Ayres)
- MINOS Scintillator Factories (Jim Grudzinski)

ZEUS Editorial Panel (Jose Repond)

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FY 2003 Budget

Total ANL HEP base budgets

	Then-year K$	2003$ Inflation Corrected	2003$ Scientific Inflation Corrected
FY 1998	7890	8927	9599
FY 1999	8065	8902	9435
FY 2000	8050	8669	9055
FY 2001	7994	8399	8646
FY 2002	7598	7788	7902
FY 2003	7728	7728	7728

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Continuing our High Priority Work

We have accepted major responsibilities in all our projects, generally included in MOUs covering detector fabrication and/or operation

- Scientific personnel in MOUs: CDF, ATLAS, ZEUS, MINOS
- Technical personnel in MOUs: CDF, ATLAS, MINOS

MOU language usually says "assuming that funding continues as expected…"

The problem is that funding has not continued "as expected"

Conclusions

Argonne has a broad, vital program that is important to the worldwide HEP program

- Accelerator R&D, Theory, Experiment

But…

With no relief: we must reduce personnel and needed work will not get done

- Already personnel reductions in FY 2002
- More will come in 2003 and important work will not get done
- Additional $500K needed in FY 2003 to meet ongoing commitments

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